CONTENTS

Preface
E. Lied, K. Julshamn, G. Lambertsen, Ø. Lie, L.R. Njaa and K. Sandnes (Bergen, Norway) vi

Protein Nutrition and Metabolism

The nutritional regulation of muscle growth and protein turnover
D.J. Millward (London, Great Britain) 1

Influence of feeding on protein metabolism in Atlantic salmon (*Salmo salar*)
B. Fauconneau, J. Breque and C. Bielle (St. Pée-sur-Nivelle, France) 29

Short-term responses of protein synthesis to re-feeding in rainbow trout
D.N. McMillan and D.F. Houlihan (Aberdeen, Great Britain) 37

Ration size in the feeding of cod (*Gadus morhua*): effect on skeletal muscle proteins, with special reference to myosin heavy chain
A. von der Decken (Stockholm, Sweden) 47

Utilization of dietary protein by the eel (*Anguilla anguilla*): optimum dietary protein levels
M. de la Higuera, M. García Gallego, A. Sanz, M.C. Hidalgo and M.D. Suárez (Granada, Spain) 53

Effect of digestible carbohydrates on protein/energy utilization and on glucose metabolism in rainbow trout (*Salmo gairdneri* R.)
S.J. Kaushik, F. Medale, B. Fauconneau and D. Blanc (St. Pée-sur-Nivelle, France) 63

An evaluation of the isolated, in vitro, non-myotomal muscle preparation for the study of factors affecting protein synthesis in fish
J.O.L. Wrigley and R. Ash (Bradford, Great Britain) 75

Estimation of protein synthesis in fish larvae using in vitro polyribosome assay
P.E. Hansen (Lyngby, Denmark), E. Lied (Bergen, Norway) and T. Børresen (Lyngby, Denmark) 85

Long-term effect of a high-protein/non-carbohydrate diet on the primary liver and kidney metabolism in rainbow trout (*Salmo gairdneri*)
J.A. Lupiáñez, M.J. Sánchez-Lozano, L. García-Rejón and M. de la Higuera (Granada, Spain) 91

Effects of ration on protein turnover in cod
D.F. Houlihan, S.J. Hall and C. Gray (Aberdeen, Great Britain) 103

A simple in vitro method for measuring protein digestibility
A.E. Eid (Ismailia, Egypt) and A.J. Matty (Stirling, Great Britain) 111

Lipid Nutrition and Metabolism

Studies on the essential fatty acid requirement of channel catfish, *Ictalurus punctatus*
S. Satoh, W.E. Poe and R.P. Wilson (Mississippi State, MS, U.S.A.) 121

Different fats in feed for salmon: influence on sensory parameters, growth rate and fatty acids in muscle and heart
M.S. Thomassen and C. Røsjø (Ås, Norway) 129

Haematological values and fatty acid composition of erythrocyte phospholipids in cod (*Gadus morhua*) fed at different water temperatures
Ø. Lie, E. Lied and G. Lambertsen (Bergen, Norway) 137

Lipid requirements of some warmwater species
R.R. Stickney and R.W. Hardy (Seattle, WA, U.S.A.) 145

The effect of enrichment diets on the fatty acid composition of the rotifer *Brachionus plicatilis*
J. Rodriguez Rainuzzo, Y. Olsen and G. Rosenlund (Trondheim, Norway) 157
Fatty acid composition of *Coregonus muksun* Pallas: changes during incubation, hatching, feeding and starvation
A. Soivio, M. Niemistö and M. Bäckström (Helsinki, Finland) 163
Effects of reduced feed ration levels on fat content and fatty acid compostion in white and red muscle from rainbow trout
A. Kiessling, L. Johansson (Uppsala, Sweden) and T. Storebakken (Ås, Norway) 169
Partial purification and characterization of a triglyceride lipase from cod (*Gadus morhua*)
D.R. Gjellesvik, A.J. Raae and B.Th. Walther (Bergen, Norway) 177
Lipid and (*n*-3) requirement of *Sparus aurata* larvae during starvation and feeding
W.M. Koven, G.Wm. Kissil and A. Tandler (Eilat, Israel) 185

Nutrition and Health
The relationship between diet and the immune response of fish
M.L. Landolt (Seattle, WA, U.S.A.) 193
Disease resistance and humoral antibody production in rainbow trout fed high levels of vitamin C
O. Navarre and J.E. Halver (Seattle, WA, U.S.A.) 207

Micronutrients
The interaction of vitamins, minerals and diet composition in the diet of fish
J.W. Hilton (Guelph, Ont., Canada) 223
High mortality of rainbow trout (*Salmo gairdneri*) fry caused by deficiency of vitamins C and B_2 in commercial fish farms in Yugoslavia
Z. Teskeredžić, E. Teskeredžić and M. Hacmanjek (Zagreb, Yugoslavia) 245
Stability of ascorbate-2-sulfate in trout feed measured by HPLC
W. Schüep, J. Marmet and W. Studer (Basle, Switzerland) 249
Dietary calcium, phytate and zinc interactions in channel catfish
D.M. Gatlin, III and H.F. Phillips (Pine Bluff, AR, U.S.A.) 259
A comparison of growth rate and trace element accumulation in Atlantic salmon (*Salmo salar*) fry fed four different commercial diets
A. Maage (Bergen, Norway), H. Sveier (Saevareid, Norway) and K. Julshamn (Bergen, Norway) 267

Physiological Aspects of Nutrition
Effects of different diets on egg production and egg quality of Atlantic salmon (*Salmo salar* L.)
P. Eskelinen (Valkola, Finland) 275
Energy metabolism in *Oreochromis niloticus*
K.-H. Meyer-Burgdorff, M.F. Osman and K.D. Günther (Göttingen, Federal Republic of Germany) 283
Physiological changes in muscle of rainbow trout fed different ration levels
A. Kiessling (Uppsala, Sweden), T. Storebakken, T. Åsgård (Sunndalsöra, Norway), I.L. Andersson and K.-H. Kiessling (Uppsala, Sweden) 293
A behavioural method to test feeding responses of fish to pelleted diets
L. Stradmeyer (Pitlochry, Great Britain) 303
Total volatile nitrogen — a quality criterion for fish silage?
H. Haaland and L.R. Njaa (Bergen, Norway) 311

Feed intake, digestibility and brain neurotransmitters of rainbow trout under hypoxia
T. Pouliot and J. de la Noüe (Ste-Foy, Que., Canada) 317
Effects of sustained exercise on growth and body composition of first-feeding fry of Arctic charr, *Salvelinus alpinus* (L.)
J.S. Christiansen, E. Ringø and M. Jobling (Tromsø, Norway) 329
Experiences with wastewater-cultured *Daphnia* in the startfeeding of rainbow trout (*Salmo gairdneri*)
G. Dave (Göteborg, Sweden) 337
Laboratory studies on the use of rotifers (*Brachionus plicatilis* O.F. Müller) as start-feed for cod larvae (*Gadus morhua* L.)
I. Opstad, B. Strand (Storebø, Norway), I. Huse (Bergen, Norway) and O. Garatun-Tjeldstø (Storebø, Norway) 345
Fish roe as a major component in start-feed for marine fish larvae
O. Garatun-Tjeldstø (Bergen, Norway), I. Opstad (Storebø, Norway), T. Hansen (Matredal, Norway) and I. Huse (Storebø, Norway) 353
Pigmentation of salmonids: interactions of astaxanthin and canthaxanthin on pigment deposition in rainbow trout
O.J. Torrissen (Matredal, Norway) 363
Effects of pigments from different sources on colour changes and growth of red *Oreochromis niloticus*
M. Boonyaratpalin (Songkhla, Thailand) and N. Unprasert (Bangkok, Thailand) 375
The effect of feeding astaxanthin to *Oreochromis niloticus* and *Colisa labiosa* on the histology of the liver
H. Segner, P. Arend, K. von Poeppinghausen and H. Schmidt (Melle, Federal Republic of Germany) 381
High mortality of rainbow trout (*Salmo gairdneri*) in Yugoslavian fish farms caused by inadequate feed quality
Z. Teskeredžić, E. Teskeredžić and L. Malnar (Zagreb, Yugoslavia) 391
Vitellogenin synthesis in Atlantic salmon (*Salmo salar*) at different acclimation temperatures
T. Olin and A. von der Decken (Stockholm, Sweden) 397
Photoperiod and temperature effects on early development and reproductive investment in Atlantic salmon (*Salmo salar* L.)
C.E. Adams (Glasgow, Great Britain) and J.E. Thorpe (Pitlochry, Great Britain) 403
The appearance of soluble antigen, horseradish peroxidase (HRP), in tissues of the rainbow trout (*Salmo gairdneri* Richardson), subsequent to variable dip-immersion procedures
E. McLean (West Vancouver, B.C., Canada), R. Ash and P.A.B. Westcott (Bradford, Great Britain) 411
Influence of diet and oxidative rancidity on fry of Atlantic and coho salmon
H.G. Ketola (Cortland, NY, U.S.A.), C.E. Smith and G.A. Kindschi (Bozeman, MT, U.S.A.) 417

Author Index 425